

# Investigation

## 2

## Linear Models and Equations

**O**rganizing and displaying the data from an experiment or survey can help you spot trends and make predictions. When the data show a linear trend, you can find a graph and equation to *model* the relationship between the variables. You can then use the model to make predictions about values between and beyond the data values.

When you make a model to represent a mathematical relationship, examine your model and ask

*For what interval of values is the model likely to be reasonably accurate?*

### 2.1 Linear Models

**T**he First State Bridge-Painting Company is often asked to bid on painting projects. It usually gets the contract if it offers the lowest price. However, it needs to make sure the bid is high enough that the company will make a reasonable profit.

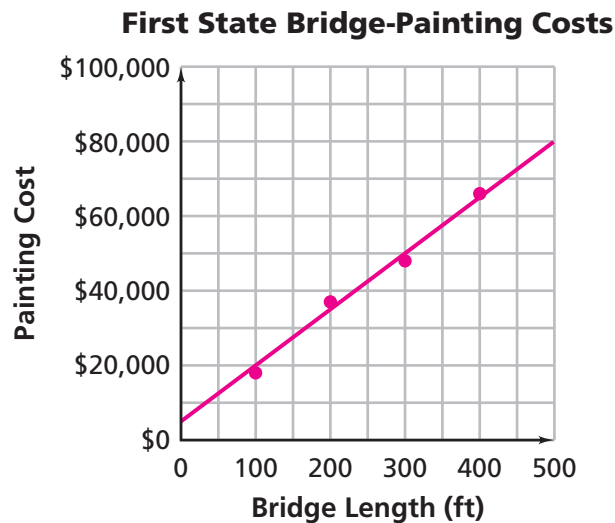
First State is preparing a bid for a bridge-painting project. The company looks at its records for previous projects. It finds information about four bridges with similar designs.

**First State Bridge-Painting Costs**

Bridge Number	Length (ft)	Painting Cost
1	100	\$18,000
2	200	\$37,000
3	300	\$48,000
4	400	\$66,000



The First State cost estimators plot the data. The points fall in a nearly linear pattern. They draw a line that fits the pattern well. The line is a **mathematical model** for the relationship between bridge length and painting cost. A mathematical model approximates a data pattern.



### Getting Ready for Problem 2.1

A mathematical model can be used to make predictions about values between and beyond the data points.

- How do you think the cost estimators decided where to draw the line?
- Is the line a reasonable model for these data?
- What information does the model give that the points alone do not?
- What questions could you answer using the model?
- What information do you need to write an equation for the line?

### Problem 2.1 Linear Models

- A. 1.** Write an equation for the line that models the data.
- 2.** Use the line or the equation to estimate painting costs for similar bridges that are
- a.** 175 feet long
  - b.** 280 feet long
- 3.** Use the line or the equation to estimate lengths of similar bridges for which the painting costs are
- a.** \$10,000
  - b.** \$60,000

- B.** First State is also bidding on a different type of bridge. It has records for three similar bridges.

**First State Bridge-Painting Costs**

Bridge Number	Length (ft)	Painting Cost
3	150	\$50,000
4	300	\$80,000
5	500	\$140,000

1. Plot these data points. Draw a line that models the pattern in the data points.
2. Write an equation for your line.
3. Use your equation or line to estimate the painting cost for a similar bridge that is 200 feet long.
4. Use your equation or line to estimate the length of a similar bridge that costs \$100,000 to paint.

**ACE** Homework starts on page 33.

